4R Nutrient Stewardship

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- Arab Fertilizer Association (AFA)
- Canadian Fertilizer Institute (CFI)
- The Fertilizer Association of India
- International Fertilizer Industry Association (IFA)
- International Potash Institute (IPI)
- The Fertilizer Institute (TFI)
- Vale Fertilizantes S.A.
4R Nutrient Stewardship

• Technical start- 1980’s; as a process in 2007 (Brussels)
• A science-based approach that offers increased production, enhanced environmental protection, increased farmer profitability and improved sustainability
• Recognizes that sustainable nutrient use must support cropping systems that provide economic, social and environmental benefits

*Right Source @ Right Rate, Right Time, Right Place*

4 Rs are interconnected ... changing one often causes changes in others
Principles of 4R Nutrient Stewardship

- Stakeholders choose goals
- Producers choose practices (S-R-T-P)
  - Specific to site (crop, soil, weather, system, etc.)
- Science links practices to goals
Universal scientific principles lead to best practices to accomplish management goals

1. Supply in plant available forms
2. Suit soil properties
3. Recognize synergisms among nutrients
4. Blend compatibility

1. Assess plant demand
2. Assess soil nutrient supply
3. Assess all available indigenous nutrient sources
4. Predict fertilizer use efficiency

All four all the time

1. Assess timing of crop uptake
2. Assess dynamics of soil nutrient supply
3. Recognize timing of weather factors
4. Evaluate logistics of operations

1. Recognize root-soil dynamics
2. Manage spatial variability
3. Fit needs of tillage system
4. Limit potential off-field transport
Examples of potential practices for each category

**Right Source**
1. Balanced fertilization that meets crop needs for macro and micronutrients
2. Appropriate form – ammonium, nitrate, urea

**Right Rate**
1. Yield goal evaluation
2. Appropriate soil testing and plant analysis
3. Consideration of crop removal
4. Recognition of spatial variability and variable rate application

**Right Time**
1. Fall N only on appropriate soils and at appropriate temperatures
2. Slow and controlled release fertilizers
3. Urease and nitrification inhibitors

**Right Place**
1. Fertilizer bands appropriately placed for crop roots
2. Applicator calibration and maintenance
3. P management modified for critical source areas within a watershed (P Index)
The role of adaptive management in 4R nutrient stewardship – focusing on your “right”

Site factors
- Crop
- Soil
- Grower
- Nutrient inputs
- Water quality
- Climate
- Weather
- Technology
- Economics

Decision Support
Based on scientific principles

Stakeholder input
Recommendation of right source, rate, time, place

Output
Decision
Action

Outcome
Feedback loop
Productivity, profitability, durability, environmental impact

Seasonal observations & data pass through the filter of scientific principles
4R Plant Nutrition – Decision Cycle

Policy Level

Regional Level
Agronomic scientists

Farm Level
Producers, Crop advisers, Dealers

LOCAL SITE FACTORS
- Climate
- Policies
- Land tenure
- Technologies
- Financing
- Prices
- Logistics
- Management
- Weather
- Soil
- Crop demand
- Potential losses
- Ecosystem vulnerability

DECISION SUPPORT based on scientific principles

OUTPUT
Recommendation of right source, rate, time, and place (BMPs)

DECISION
Accept, revise, or reject

ACTION
Change in practice

EVALUATION of OUTCOME
Cropping System Sustainability Performance
Performance Indicators

**ECONOMIC**
- Return on investment
- Soil productivity
- Farm income
- Yield stability

**YIELD**
- Quality
- Nutrient loss
- Nutrient balance
- Energy
- Labor
- Nutrient
- Water

**ENVIRONMENTAL**
- Biodiversity
- Soil erosion
- Water & air quality
- Ecosystems services
- Afforable food
- Working conditions

**SOURCE**
- Right Source

**RATE**
- Right Rate

**TIME**
- Right Time

**PLACE**
- Right Place

**Right Source at Right Rate, Right Time, Right Place**
• Diversified cooperative
• 3 southern states; 46 branches
• 17,000 members; 460 employees
And, rice yields in the region are increasing over 4% per year – the highest rate in the world.

4R Nutrient Stewardship?
• Putting members’ products on supermarket shelves
• Guaranteed origin
• Sustainably grown for world markets

Cooplantio is responding to stakeholder (customer) concerns
For more information on 4R Nutrient Stewardship

http://www.nutrientstewardship.com/

http://www.ipni.net/4r
Foreword

Chapter 1  Goals of Sustainable Agriculture ...........................................

Chapter 2  The 4R Nutrient Stewardship Concept ...............................  

Chapter 3  Scientific Principles Supporting — Right Source ..............  

Chapter 4  Scientific Principles Supporting — Right Rate .................  

Chapter 5  Scientific Principles Supporting — Right Time................  

Chapter 6  Scientific Principles Supporting — Right Place.................  

Chapter 7  Adapting Practices to the Whole Farm .............................  

Chapter 8  Supporting Practices......................................................  

Chapter 9  Nutrient Management Planning and Accountability .........  

Symbols and Abbreviations............................................................  

Glossary...........................................................................  

Review Answers........................................................................  

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Thank you for attention!

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